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Research Article

# A new species of the genus *Ovophis* Burger in Hoge & Romano-Hoge, 1981 (Serpentes, Viperidae) from southern Yunnan, China

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## Abstract

A new species of *Ovophis* is described from Yuanyang Guanyinshan Provincial Nature Reserve in southern Yunnan Province, China. The new species can be distinguished from congeneric species by the following combination of characters: ratio of tail length to total length 0.191–0.206, internasals separated by one or two scales, dorsal scales in 22-21-17 rows, ventrals 146–148, subcaudals 57–64, most subcaudals paired and a few unpaired, third supralabial larger than fourth, white spots on dorsal tail continuous. This study further reveals that the species diversity of *Ovophis* has been seriously underestimated, and there is still a lot of work to be done on the taxonomy of this genus.

**Key words:** cytochrome *b* gene, morphology, mountain pitvipers, systematics, taxonomy

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## Introduction

The genus *Ovophis* Burger in Hoge & Romano-Hoge, 1981 is a group of medium-sized venomous snakes that are widely distributed in mountainous areas of eastern Asia, southern Himalayas, and Indochina (Leviton et al. 2003; Neang et al. 2011; Che et al. 2020; Guo et al. 2022; Guo and Che 2024). Currently, this genus is recognized to contain seven species, namely *O. monticola* (Günther, 1864), *O. convictus* (Stoliczka, 1870), *O. makazayazaya* (Takahashi, 1922), *O. tonkinensis* (Bourret, 1934), *O. zayuensis* (Jiang, 1977), *O. anitae* David, Frétey & Vogel, 2024, and *O. jenkinsi* Qiu, Wang, Xia, Jiang, Zeng, Wang, Li & Shi, 2024 (Qiu et al. 2024). In addition, *Trimeresurus okinavensis* Boulenger, 1892 and *Trimeresurus gracilis* Oshima, 1920 may also belong to this genus since they share similar morphological characteristics with the above seven species (Uetz et al. 2025). However, these two species were not supported in *Ovophis* based on molecular data (Malhotra and Thorpe 2000, 2004; Li et al. 2020; Shi et al. 2021). Therefore, recent taxonomic studies did not include these two species in *Ovophis* (e.g., Zeng et al. 2023; Qiu et al. 2024).

Previously, *Ovophis monticola* was considered a widely distributed species, and the snakes of this genus occurring in Yunnan Province of China were all considered to be *O. monticola* (Zhao et al. 1998; Zhao 2006; Yang and Rao 2008). Afterwards, Malhotra et al. (2011) conducted a taxonomic revision of *Ovophis* and considered that more than one species of this genus is distributed in Yunnan, while the true *O. monticola* is not found in Yunnan. Subsequently, Zeng et al. (2023) conducted further evaluation of *Ovophis* and described a new species of this genus from Yunnan. However, David et al. (2024) considered that the nomen "*Ovophis malhotrae*" proposed by Zeng et al. (2023) is nomenclaturally unavailable and proposed for it a new nomen. Therefore, four species of *Ovophis* are distributed in Yunnan currently, namely *O. makazayazaya*, *O. zayuensis*, *O. anitae*, and *O. jenkinsi* (Zeng et al. 2023; David et al. 2024; Qiu et al. 2024).

During our recent fieldwork in southern Yunnan, China, some mountain pitviper specimens were collected from Yuanyang Guanyinshan Provincial Nature Reserve. Molecular and morphological comparison revealed that these specimens belong to a distinct taxon in the genus *Ovophis*. Herein, we describe this taxon as a new species.

## Material and methods

Field surveys were conducted in Yuanyang Guanyinshan Provincial Nature Reserve, Yuanyang County, Honghe Hani and Yi Autonomous Prefecture, Yunnan Province, China, under the permit from Yuanyang Guanyinshan Provincial Nature Reserve Management and Protection Bureau. Specimens were preserved in approximately 75% ethanol and then deposited at Kunming Natural History Museum of Zoology, Kunming Institute of Zoology, Chinese Academy of Sciences (KIZ).

Total genomic DNA was extracted from liver tissues. Fragments of mitochondrial cytochrome *b* (*Cytb*) gene were amplified and sequenced using the primers L14910 and H16064 (Burbrink et al. 2000). Amplification and sequencing were completed by Sangon Biotech (Shanghai) Co., Ltd. Newly generated sequences have been deposited in GenBank and homologous sequences were obtained from GenBank (Table 1).

Sequences were aligned using MAFFT 7.471 (Katoh and Standley 2013). A Bayesian inference (BI) was performed in MrBayes 3.2.7 (Ronquist et al. 2012) using the GTR+F+I+G4 model and a maximum likelihood (ML) analysis was performed in IQ-TREE 1.6.12 (Nguyen et al. 2015) using the TN+F+I+G4 model, which was selected under the Akaike Information Criterion in ModelFinder (Kalyaanamoorthy et al. 2017). The technical computation methods for BI and ML phylogenetic analyses and genetic divergences calculation were the same as those in Liu et al. (2023).

Measurements were taken with a digital caliper to the nearest 0.1 mm. Measurement methodology followed David and Vogel (2012). Values for symmetric head characters are given in left/right order. The following morphological characteristics were noted:

**Cep** cephalic scales, number on a line between the middle of supraoculars;
**DSR** dorsal scale rows, at one head length behind the head, at midbody (namely at SVL/2), and at one head length before the vent, respectively;
**HL** head length, from the tip of the snout to the angle of the jaw;

**IL** infralabial scales;
**SC** subcaudal plates;
**SL** supralabial scales;
**SVL** snout-vent length;
**TaL** tail length;
**TL** total length;
**VEN** ventral plates.

**Table 1.** Samples used for the phylogenetic analyses in this study.

| Species | Voucher | Locality | GenBank Accession |
|---|---|---|---|
| *Ovophis zhaoermii* sp. nov. | KIZ2023041 | Yuanyang, Yunnan, China | PV035804 |
| *Ovophis zhaoermii* sp. nov. | KIZ2024078 | Yuanyang, Yunnan, China | PV035805 |
| *Ovophis zhaoermii* sp. nov. | KIZ2024079 | Yuanyang, Yunnan, China | PV035806 |
| *Ovophis zhaoermii* sp. nov. | KIZ2024080 | Yuanyang, Yunnan, China | PV035807 |
| *Ovophis anitae* | GP 2041 | Yunnan, China | OP441841 |
| *Ovophis anitae* | GP 2053 | Jinping, Yunnan, China | OP441842 |
| *Ovophis anitae* | GP 2225 | Jinping, Yunnan, China | OP441843 |
| *Ovophis anitae* | ROM 39381 | Lao Cai, Vietnam | HQ325160 |
| *Ovophis anitae* | ROM 39382 | Lao Cai, Vietnam | HQ325161 |
| *Ovophis anitae* | ROM 39384 | Lao Cai, Vietnam | HQ325162 |
| *Ovophis anitae* | YBU 19103 | Pingbian, Yunnan, China | OP441844 |
| *Ovophis convictus* | AM B580 | Cameron highlands, Pahang, Malaysia | HQ325129 |
| *Ovophis convictus* | AM B628 | Cameron highlands, Pahang, Malaysia | HQ325141 |
| *Ovophis convictus* | AM B629 | Pulau Langkawi, Malaysia | HQ325142 |
| *Ovophis jenkinsi* | IOZ 002680 | Yingjiang, Yunnan, China | PP171455 |
| *Ovophis jenkinsi* | IOZ 002679 | Yingjiang, Yunnan, China | PP171456 |
| *Ovophis jenkinsi* | CAS 224424 | Kachin, Myanmar | HQ325176 |
| *Ovophis jenkinsi* | CAS 234763 | Kachin, Myanmar | HQ325179 |
| *Ovophis jenkinsi* | CAS 234866 | Kachin, Myanmar | HQ325180 |
| *Ovophis jenkinsi* | GP 1617 | Myitkyina, Kachin, Myanmar | OP441885 |
| *Ovophis makazayazaya* | AM A87 | Taiwan, China | AF171907 |
| *Ovophis makazayazaya* | AM B480 | Yunnan, China | HQ325123 |
| *Ovophis makazayazaya* | AM B482 | China | AY352748 |
| *Ovophis makazayazaya* | AM B578 | China | HQ325128 |
| *Ovophis makazayazaya* | AM B664 | Sichuan, China | HQ325143 |
| *Ovophis makazayazaya* | AM B665 | Sichuan, China | HQ325144 |
| *Ovophis makazayazaya* | AM B666 | Sichuan, China | HQ325145 |
| *Ovophis makazayazaya* | AM B669 | Sichuan, China | HQ325146 |
| *Ovophis makazayazaya* | AM B791 | Yunnan, China | HQ325173 |
| *Ovophis makazayazaya* | AM B793 | Yunnan, China | HQ325174 |
| *Ovophis makazayazaya* | AM B795 | Yunnan, China | HQ325175 |
| *Ovophis makazayazaya* | CAS 23440 | Yunnan, China | HQ325178 |
| *Ovophis makazayazaya* | GP 19 | Hongya, Sichuan, China | OP441864 |
| *Ovophis makazayazaya* | GP 20 | Hongya, Sichuan, China | HQ325165 |
| *Ovophis makazayazaya* | GP 21 | Huili, Sichuan, China | OP441856 |
| *Ovophis makazayazaya* | GP 23 | Yunnan, China | AY763230 |
| *Ovophis makazayazaya* | GP24/R01 | Jingdong, Yunnan, China | HQ325166 |
| *Ovophis makazayazaya* | GP 25 | Hongya, Sichuan, China | HQ325167 |
| *Ovophis makazayazaya* | GP 214 | Anzhou, Sichuan, China | OP441863 |
| *Ovophis makazayazaya* | GP 227 | Hekou, Yunnan, China | HQ325170 |

| Species | Voucher | Locality | GenBank Accession |
|---|---|---|---|
| *Ovophis makazayazaya* | GP 228 | Hekou, Yunnan, China | HQ325171 |
| *Ovophis makazayazaya* | GP 343 | Shimen, Hunan, China | HQ325172 |
| *Ovophis makazayazaya* | GP 1030 | Yizhang, Hunan, China | OP441848 |
| *Ovophis makazayazaya* | GP 2052 | Jiangxi, China | OP441845 |
| *Ovophis makazayazaya* | GP 2544 | Hongkou, Sichuan, China | OP441866 |
| *Ovophis makazayazaya* | GP 3831 | Qianshan, Jiangxi, China | OP441846 |
| *Ovophis makazayazaya* | GP 5058 | Kaihua, Zhejiang, China | OP441847 |
| *Ovophis makazayazaya* | GP 6748 | Shangri-La, Yunnan, China | OP441857 |
| *Ovophis makazayazaya* | GP 7749 | Xuyong, Sichuan, China | OP441870 |
| *Ovophis makazayazaya* | KIZ 02143 | Luquan, Yunnan, China | OP441860 |
| *Ovophis makazayazaya* | KIZ 03100 | Youyang, Chongqing, China | OP441853 |
| *Ovophis makazayazaya* | KIZ 037717 | Fugong, Yunnan, China | OP441858 |
| *Ovophis makazayazaya* | KIZ 037718 | Fugong, Yunnan, China | OP441859 |
| *Ovophis makazayazaya* | KIZ 09136 | Pingbian, Yunnan, China | OP441852 |
| *Ovophis makazayazaya* | NTNU B200800 | Taiwan, China | DQ305463 |
| *Ovophis makazayazaya* | SCUM035040 | Huili, Sichuan, China | AY763229 |
| *Ovophis makazayazaya* | YBU 061033 | Anzhou, Sichuan, China | OP441867 |
| *Ovophis makazayazaya* | YBU 091099 | Changning, Sichuan, China | OP441871 |
| *Ovophis makazayazaya* | YBU 09115 | Changning, Sichuan, China | OP441865 |
| *Ovophis makazayazaya* | YBU 11160 | Leishan, Guizhou, China | OP441849 |
| *Ovophis makazayazaya* | YBU 13314A | Shennongjia, Hubei, China | OP441869 |
| *Ovophis makazayazaya* | YBU 13315A | Shennongjia, Hubei, China | OP441874 |
| *Ovophis makazayazaya* | YBU 14212 | Lincang, Yunnan, China | OP441854 |
| *Ovophis makazayazaya* | YBU 14281 | Mengzi, Yunnan, China | OP441850 |
| *Ovophis makazayazaya* | YBU 15042 | Wenshan, Yunnan, China | OP441855 |
| *Ovophis makazayazaya* | YBU 15043 | Wenshan, Yunnan, China | OP441851 |
| *Ovophis makazayazaya* | YBU 15186 | Muchuan, Sichuan, China | OP441873 |
| *Ovophis makazayazaya* | YBU 15191 | Muchuan, Sichuan, China | OP441872 |
| *Ovophis makazayazaya* | YBU 18171 | Hekou, Sichuan, China | OP441868 |
| *Ovophis makazayazaya* | YPX 53011 | Weixi, Yunnan, China | OP441861 |
| *Ovophis makazayazaya* | YPX 53013 | Weixi, Yunnan, China | OP441862 |
| *Ovophis makazayazaya* | ZMB 70214 | China | HQ325137 |
| *Ovophis makazayazaya* | ZMB 70219 | China | HQ325134 |
| *Ovophis makazayazaya* | ZMB 70220 | China | HQ325135 |
| *Ovophis makazayazaya* | ZMB 70221 | China | HQ325136 |
| *Ovophis monticola* | ZMB 70216 | Gandaki, Nepal | HQ325138 |
| *Ovophis monticola* | ZMB 70218 | Gandaki, Nepal | HQ325131 |
| *Ovophis monticola* | GP 2028 | Nyalam, Xizang, China | OP441883 |
| *Ovophis monticola* | GP 2050 | Nyalam, Xizang, China | OP441884 |
| *Ovophis tonkinensis* | AM B581 | China | HQ325130 |
| *Ovophis tonkinensis* | AM B806 | Hainan, China | HQ325181 |
| *Ovophis tonkinensis* | GP 1632 | Maoming, Guangdong, China | OP441875 |
| *Ovophis tonkinensis* | GP 1665 | Maoming, Guangdong, China | OP441876 |
| *Ovophis tonkinensis* | GP 2140 | Lingshui, Hainan, China | OP441877 |
| *Ovophis tonkinensis* | GP 7703 | Hainan, China | OP441878 |
| *Ovophis tonkinensis* | KIZ 011602 | Xuan Son, Phu Tho, Vietnam | OP441880 |
| *Ovophis tonkinensis* | KIZ 022262 | Xing 'an, Guangxi, China | OP441881 |
| *Ovophis tonkinensis* | MVZ 226627 | Vinh Phuc, Vietnam | HQ325151 |
| *Ovophis tonkinensis* | ROM 29763 | Vinh Phuc, Vietnam | HQ325157 |
| *Ovophis tonkinensis* | ROM 30776 | Gia Lai, Vietnam | HQ325164 |
| *Ovophis tonkinensis* | ROM 31082 | Vinh Phuc, Vietnam | HQ325158 |
| *Ovophis tonkinensis* | ROM 7798 | Gia Lai, Vietnam | AY223572 |
| *Ovophis tonkinensis* | YPX 28352 | Lingshui, Hainan, China | OP441882 |

| Species | Voucher | Locality | GenBank Accession |
|---|---|---|---|
| *Ovophis tonkinensis* | ZMB 70223 | China | HQ325132 |
| *Ovophis tonkinensis* | ZMB 70224 | Lao Cai, Vietnam | HQ325133 |
| *Ovophis tonkinensis* | ZMB 70225 | China | HQ325139 |
| *Ovophis tonkinensis* | ZMB 70226 | China | HQ325140 |
| *Ovophis zayuensis* | CAS 233203 | Kachin, Myanmar | HQ325177 |
| *Ovophis zayuensis* | GP 89 | Mêdog, Xizang, China | OP441887 |
| *Ovophis zayuensis* | GP 90 | Zayü, Xizang, China | HQ325168 |
| *Ovophis zayuensis* | GP 92 | Gongshan, Yunnan, China | HQ325169 |
| *Ovophis zayuensis* | GP 557 | Bayi, Xizang, China | OP441889 |
| *Ovophis zayuensis* | GP 594 | Bayi, Xizang, China | OP441893 |
| *Ovophis zayuensis* | GP 611 | Bayi, Xizang, China | OP441891 |
| *Ovophis zayuensis* | GP 713 | Bomi, Xizang, China | OP441890 |
| *Ovophis zayuensis* | GP 1388 | Mêdog, Xizang, China | OP441886 |
| *Ovophis zayuensis* | GP 1505 | Zayü, Xizang, China | OP441892 |
| *Ovophis zayuensis* | KIZ 010968 | Mêdog, Xizang, China | MW111486 |
| *Ovophis zayuensis* | KIZ 035124 | Gongshan, Yunnan, China | OP441895 |
| *Ovophis zayuensis* | KIZ 037721 | Lushui, Yunnan, China | OP441894 |
| *Ovophis zayuensis* | KIZYPX27835 | Bomi, Xizang, China | MW133461 |
| *Ovophis zayuensis* | KIZYPX27855 | Zayü, Xizang, China | MW133460 |
| *Ovophis zayuensis* | KIZYPX27857 | Nyingchi, Xizang, China | MW133459 |
| *Ovophis zayuensis* | YBU 071107 | Bayi, Xizang, China | OP441888 |
| *Ovophis* cf. *meridionalis* | ROM 39385 | Lao Cai, Vietnam | HQ325163 |
| *Ovophis* cf. *meridionalis* | ROM 39386 | Lao Cai, Vietnam | HQ325154 |
| *Ovophis* cf. *meridionalis* | ROM 39387 | Lao Cai, Vietnam | HQ325155 |
| *Ovophis* cf. *meridionalis* | ROM 39388 | Lao Cai, Vietnam | HQ325156 |
| *Ovophis* cf. *tonkinensis* | GP 2042 | Guangxi, China | OP441879 |
| *Ovophis* cf. *tonkinensis* | ROM 35310 | Cao Bang, Vietnam | HQ325159 |
| *Ovophis* sp. | FMNH 258632 | Xe Kong, Laos | HQ325124 |
| *Ovophis* sp. | FMNH 258633 | Champassak, Laos | HQ325125 |
| *Ovophis* sp. | FMNH 258634 | Champassak, Laos | HQ325126 |
| *Ovophis* sp. | FMNH 258635 | Champassak, Laos | HQ325127 |
| *Ovophis* sp. | ROM 37617 | Kon Tum, Vietnam | HQ325152 |
| *Ovophis* sp. | ROM 37618 | Kon Tum, Vietnam | HQ325153 |
| *Protobothrops mucrosquamatus* | GP 5683 | Cuiping, Sichuan, China | OP441896 |

## Results

The BI and ML analyses yielded a consistent topology, which was almost identical to that published in Zeng et al. (2023). The sequences of the specimens from Yuanyang Guanyinshan Provincial Nature Reserve formed a distinct clade sister to a clade consisting of sequences of specimens from Lao Cai, Vietnam with strong support by both BI and ML, and then they together formed a clade sister to *Ovophis zayuensis* with strong support by BI (Fig. 1). The uncorrected pairwise distance between the sequences of the specimens from Yuanyang Guanyinshan Provincial Nature Reserve and the clade consisting of sequences of specimens from Lao Cai, Vietnam was 4.0%, the uncorrected pairwise distance between the sequences of the specimens from Yuanyang Guanyinshan Provincial Nature Reserve and the sequences of *O. zayuensis* was 7.4%, and the uncorrected pairwise distances between the sequences of the specimens from Yuanyang Guanyinshan Provincial Nature Reserve and the sequences of other species of this genus ranged from 9.1% to 13.0% (Table 2).

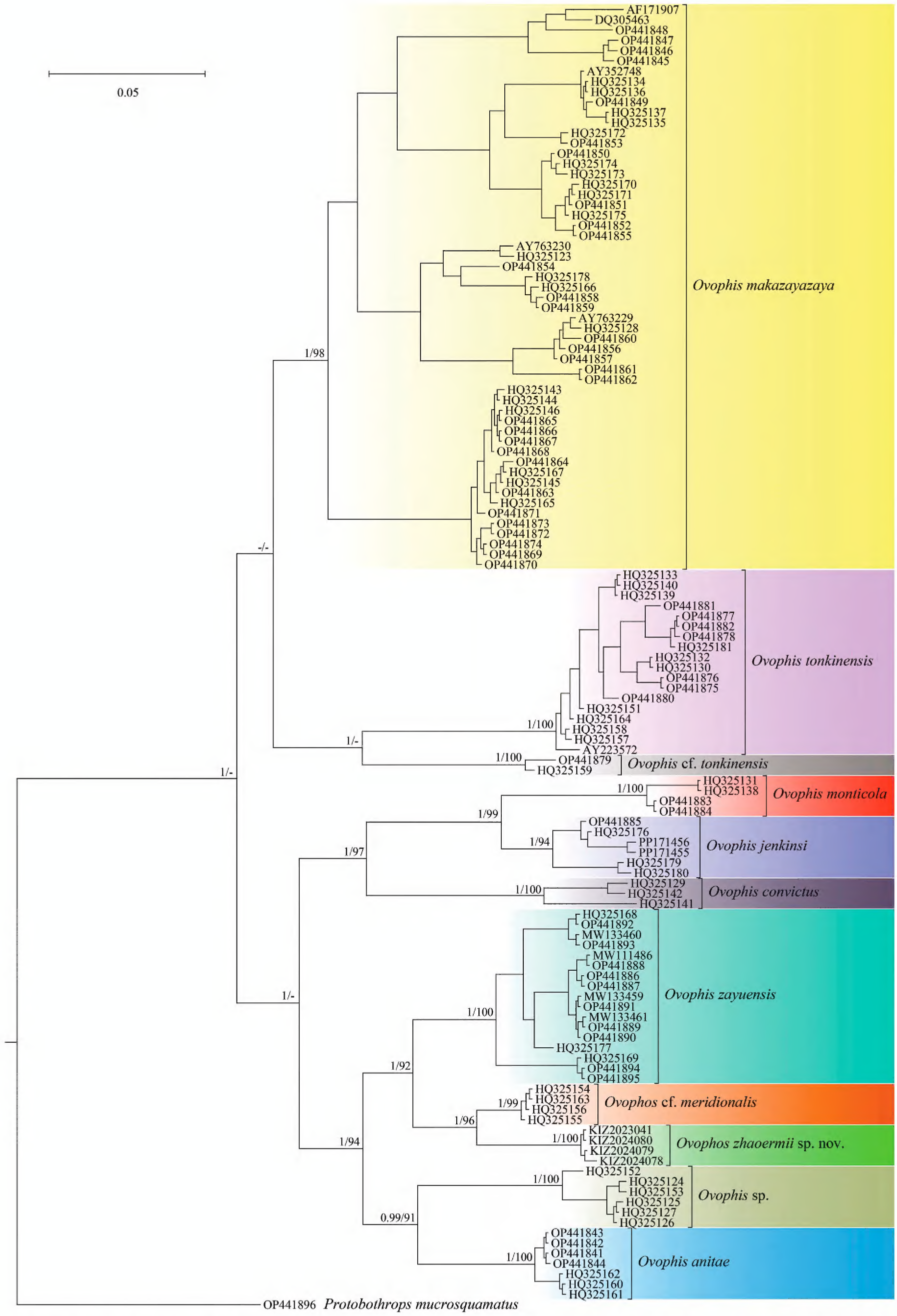


**Figure 1.** Bayesian phylogram of the genus *Ovophis* inferred from *Cytb* sequences. Numbers after and behind "/" are Bayesian posterior probabilities and ML ultrafast bootstrap values (only values above 0.90/90 are shown), respectively.

**Table 2.** Uncorrected pairwise genetic distances (%) estimated from *Cytb* sequences.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 *Ovophis zhaoermii* sp. nov. | | | | | | | | | | |
| 2 *Ovophis anitae* | 9.1 | | | | | | | | | |
| 3 *Ovophis convictus* | 11.6 | 10.9 | | | | | | | | |
| 4 *Ovophis jenkinsi* | 11.9 | 11.5 | 11.6 | | | | | | | |
| 5 *Ovophis makazayazaya* | 11.6 | 10.8 | 12.7 | 11.9 | | | | | | |
| 6 *Ovophis monticola* | 13.0 | 12.4 | 12.2 | 7.2 | 13.3 | | | | | |
| 7 *Ovophis tonkinensis* | 11.7 | 10.9 | 12.4 | 11.9 | 11.1 | 13.7 | | | | |
| 8 *Ovophis zayuensis* | 7.4 | 8.5 | 11.4 | 10.0 | 10.8 | 12.2 | 11.5 | | | |
| 9 *Ovophis* cf. *meridionalis* | 4.0 | 7.5 | 9.8 | 10.6 | 10.3 | 13.1 | 10.5 | 6.2 | | |
| 10 *Ovophis* cf. *tonkinensis* | 12.4 | 10.6 | 12.9 | 12.0 | 10.2 | 13.8 | 9.2 | 11.1 | 11.0 | |
| 11 *Ovophis* sp. | 9.6 | 8.1 | 12.6 | 11.4 | 12.1 | 12.6 | 11.8 | 9.1 | 8.9 | 11.3 |

***Ovophis zhaoermii* sp. nov.**

https://zoobank.org/43381C87-E16A-455D-AB2A-DD7F15E88BA2

Figs 2–4

**Material examined.** ***Holotype*.** • KIZ2024078, adult male, collected on 23 July 2024 by Shuo Liu from Yuanyang Guanyinshan Provincial Nature Reserve, Yuanyang County, Honghe Hani and Yi Autonomous Prefecture, Yunnan Province, China (23°1'43"N, 102°56'11"E; 2400 m a.s.l.). ***Paratypes*.** • KIZ2023041, adult male, collected on 16 May 2023, and KIZ2024079–KIZ2024080, two adult males, collected on 16 July 2024, all by Shuo Liu from the same locality as the holotype.

**Diagnosis.** Ratio of tail length to total length 0.191–0.206, internasals separated by one or two scales, second supralabial bordering loreal pit, dorsal scales in 22-21-17 rows, ventrals 146–148, subcaudals 57–64, 3–11 subcaudals unpaired and other subcaudals paired, third supralabial larger than fourth, dorsal surface of head unpatterned, dorsal surface of body brownish-black or reddish-brown with rectangular black blotches, series of white spots on dorsal surface of tail continuous, iris off-white with a black mesh pattern.

**Description of holotype.** Adult male; body relatively slender, tail relatively short, SVL 541 mm, TaL 133 mm, TaL/TL 0.197; head approximately pear shaped, distinct from neck, HL/SVL 0.05; snout blunt and rounded, rostral trapezoidal, upper tip slightly visible from above; eye small, pupil vertically elliptic; supraocular 1/1, elongate, oval, largest scales on dorsal head, separated by six small scales; nostril close to snout tip; two internasals, approximately rectangular, separated by one small scale; two much smaller scales between rostral and internasals; loreal 1/1; preoculars 3/3; postoculars 2/3; suboculars 1/3, separated from supralabials by two rows of scales; supralabials 8/9, first and second in contact with nasal, second bordering loreal pit, third larger than fourth; infralabials 9/10, first pair contacting each other behind mental, first to third in contact with chin shields; mental triangular; one pair of chin shields, meeting in midline; dorsal scales in 22-21-17 rows, distinctly keeled except outer row; ventral scales 148, excluding four preventrals; subcaudal scales 61, first to eleventh unpaired, others paired; cloacal plate undivided.

***Color of holotype in life*.** Dorsal surface of head brownish-black; lateral surface of head dark reddish-brown, a wide brownish-black stripe behind eye on each side, a narrow discontinuous white stripe from mouth corner to lateral neck on each side;

**Figure 2.** Dorsal view (top) and ventral view (bottom) of the type series of *Ovophis zhaoermii* sp. nov. in preservative.

**Figure 3.** The holotype (KIZ2024078) of *Ovophis zhaoermii* sp. nov. in life **A** general view **B** dorsal view of the head **C** left view of the head **D** right view of the head **E** dorsal view of the tail.

lower lip reddish-brown with some irregular white blotches; dorsal surface of body brownish-black with many rectangular, large black blotches on dorsolateral surface, blotches of left and right sides arranged approximately in staggered pattern; two black spots below each black dorsolateral blotch; some irregular black blotches on ventrolateral part of body; anterior dorsal surface of tail dark brownish-black, posterior dorsal surface of tail white, composed of a continuous series of white spots on two medial rows of scales; ventral surface of head reddish-brown with some irregular white blotches; ventral surface of body and tail brownish-yellow with many irregular grayish-brown blotches; iris off-white with a black mesh pattern.

**Variations.** Morphometric and meristic data of the type series are provided in Table 3. The paratypes resemble the holotype in most aspects except for small differences in body size, relative tail length, and the number of unpaired subcaudals. In addition, the larger paratype (KIZ2024080) resembles the holotype in coloration, while the two smaller paratypes (KIZ2023041 and KIZ2024079) have lighter body coloration than the holotype.

**Figure 4.** The paratypes of *Ovophis zhaoermii* sp. nov. in life **A** KIZ2024079 **B** KIZ2024080 **C** KIZ2023041.

**Table 3.** Measurements (in mm) and scalation data of the type specimens of *Ovophis zhaoermii* sp. nov.

| | KIZ2024078 | KIZ2024079 | KIZ2024080 | KIZ2023041 |
|---|---|---|---|---|
| | Holotype | Paratype | Paratype | Paratype |
| | Male | Male | Male | Male |
| SVL | 541 | 396 | 543 | 461 |
| HL | 26.7 | 21.0 | 27.6 | 25.0 |
| TaL | 133 | 103 | 132 | 109 |
| TL | 674 | 499 | 675 | 570 |
| TaL/TL | 0.197 | 0.206 | 0.196 | 0.191 |
| Cep | 6 | 6 | 7 | 7 |
| DSR | 22-21-17 | 22-21-17 | 22-21-17 | 22-21-17 |
| SL | 8/9 | 9/9 | 8/8 | 8/8 |
| IL | 9/10 | 10/10 | 10/10 | 9/10 |
| VEN | 148 | 147 | 147 | 146 |
| SC | 61 ($1^{st}$–$11^{th}$ unpaired) | 64 ($4^{th}$–$11^{th}$ unpaired) | 61 ($4^{th}$–$6^{th}$ unpaired) | 57 ($15^{th}$–$23^{th}$ unpaired) |

**Ecology notes.** The specimens of the new species were found on the ground beside a stream at night. No other reptile species were found at the type locality of the new species, but many amphibian species were found in sympatry, including *Amolops minutus* Orlov & Ho, 2007, *A. viridimaculatus* (Jiang, 1983), *Atympanophrys gigantica* (Liu, Hu & Yang, 1960), *Feihyla fuhua* Fei, Ye & Jiang, 2010, *Hyla annectans* (Jerdon, 1870), *Leptobrachium ailaonicum* (Yang, Chen & Ma, 1983), *Nanorana aenea* (Smith, 1922), and *Zhangixalus duboisi* (Ohler, Marquis, Swan & Grosjean, 2000). Therefore, we presume the new species may prey on frogs in the wild.

**Distribution.** The new species is currently known only from Yuanyang Guanyinshan Provincial Nature Reserve in Yuanyang County, Honghe Hani and Yi Autonomous Prefecture, Yunnan Province, China (Fig. 5).

**Etymology.** Named after the renowned Chinese herpetologist, Prof. Ermi Zhao (1930–2016). The designation of this specific epithet honors his great contribution to herpetological research in China, especially in snake research. According to the type locality of this species, we suggest the English common name "Guanyinshan mountain pitviper" and the Chinese common name "观音山烙铁头蛇 (Pinyin: guān yīn shān lào tiě tóu shé)".

**Comparisons.** *Ovophis zhaoermii* sp. nov. can be differentiated from *O. anitae* by having a relatively longer tail (TaL/TL 0.191–0.206 vs 0.133), having more subcaudal scales (57–64 vs 47), some of the subcaudal scales being unpaired (vs all of the subcaudal scales being paired), dorsal scales being in 22-21-17 rows (vs 27-23-19 rows), and the second supralabial bordering the loreal scale (vs the second supralabial being separated from the loreal scale).

*Ovophis zhaoermii* sp. nov. can be differentiated from *O. convictus* by having a relatively longer tail (TaL/TL 0.191–0.206 vs 0.064–0.128), having more subcaudal scales (57–64 vs 17–31), having more ventral scales (146–148 vs 120–140), some of the subcaudal scales being unpaired (vs all of the subcaudal scales being paired), and having continuous white spots on the dorsal surface of the tail (vs scattered white spots on the dorsal surface of the tail).

*Ovophis zhaoermii* sp. nov. can be differentiated from *O. makazayazaya* by having more subcaudal scales (57–64 vs 34–52), some of the subcaudal scales being unpaired (vs all of the subcaudal scales being paired), the third supralabial being larger than the fourth (vs the fourth supralabial being larger

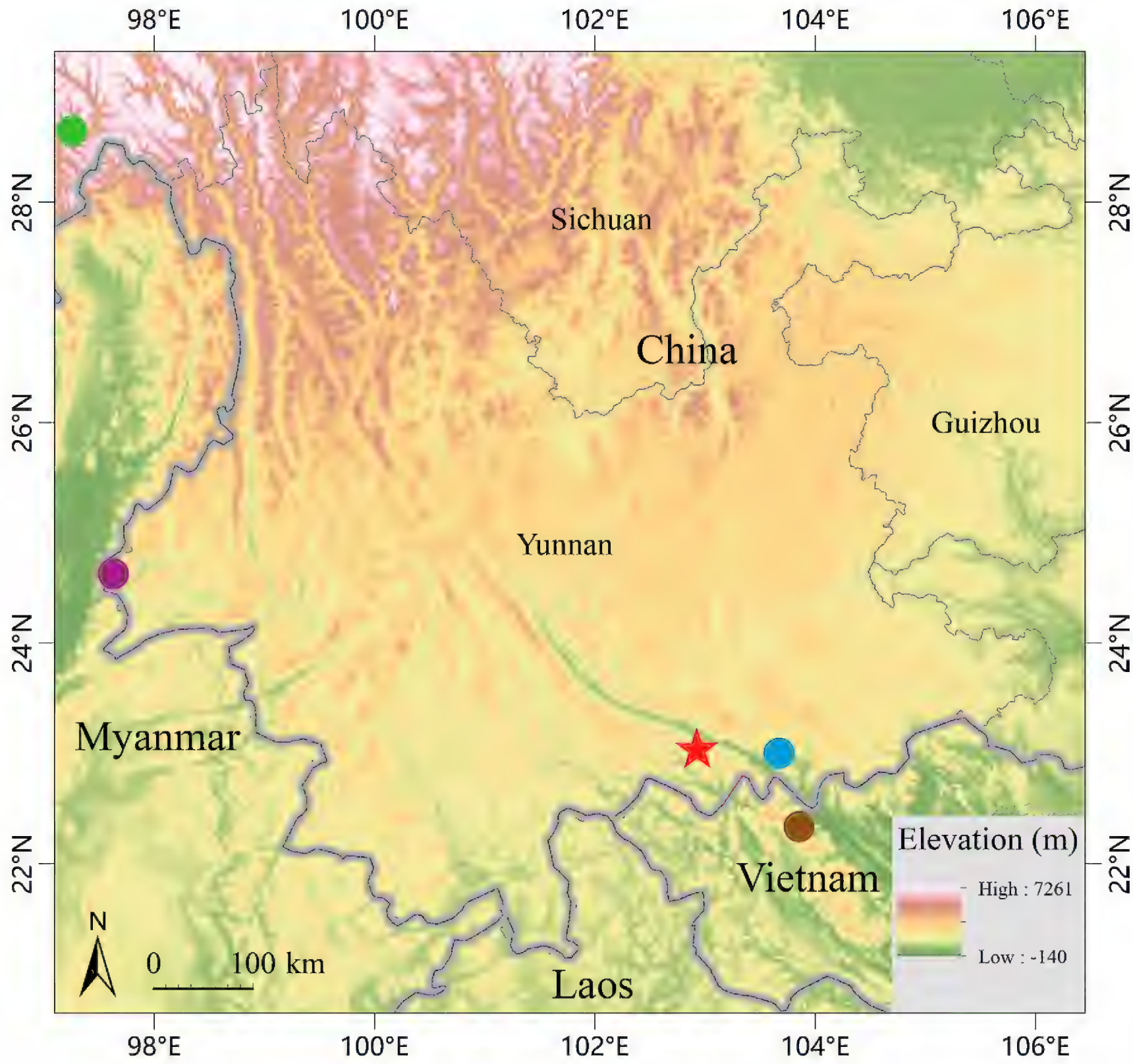


**Figure 5.** Map showing the type localities of *Ovophis zhaoermii* sp. nov. (red star), *O. anitae* (blue dot), *O. jenkinsi* (purple dot), *O. zayuensis* (green dot), and *Trimeresurus monticola meridionalis* (brown dot).

than the third), and having continuous white spots on the dorsal surface of the tail (vs scattered white spots on the dorsal surface of the tail).

*Ovophis zhaoermii* sp. nov. can be differentiated from *O. monticola* by having an unpatterned dorsal head surface (vs patterned dorsal head surface), having relatively more subcaudal scales (57–64 vs 37–58), some of the subcaudal scales being unpaired (vs all of the subcaudal scales being paired), the dorsal scales being in 22-21-17 rows (vs 23 or 21-23 or 21-19 rows), and having continuous white spots on the dorsal surface of the tail (vs scattered white spots on the dorsal surface of the tail).

*Ovophis zhaoermii* sp. nov. can be differentiated from *O. jenkinsi* by having a relatively longer tail (TaL/TL 0.191–0.206 vs 0.132–0.184), having more subcaudal scales (57–64 vs 40–52), having more ventral scales (146–148 vs 134–142), some of the subcaudal scales being unpaired (vs all of the subcaudal scales being paired), having an unpatterned dorsal head surface (vs patterned dorsal head surface), and having continuous white spots on the dorsal surface of the tail (vs scattered white spots on the dorsal surface of the tail).

*Ovophis zhaoermii* sp. nov. can be differentiated from *O. tonkinensis* by having more subcaudal scales (57–64 vs 39–49), having more ventral scales (146–148 vs 128–134), most of the subcaudal scales being paired (vs all or most of the subcaudal scales being unpaired), and the third supralabial being larger than the fourth (vs the fourth supralabial being larger than the third).

*Ovophis zhaoermii* sp. nov. can be differentiated from *O. zayuensis* by having fewer ventral scales (146–148 vs 160–177), most of the subcaudal scales being paired (vs all or most of the subcaudal scales being unpaired), the dorsal scales being in 22-21-17 rows (vs 25 or 27-23-19 or 17 rows), and having continuous white spots on the dorsal surface of the tail (vs no visible white spots on the dorsal surface of the tail).

## Discussion

In the phylogenetic analysis, the sequences which were regarded as *Ovophis tonkinensis* by Zeng et al. (2023) formed two highly divergent clades, with a genetic distance of up to 9.2%. The first clade contained some sequences of specimens from southeastern China and northern and central Vietnam, which cover the type locality of *O. tonkinensis*, while the second clade contained two sequences of specimens from Guangxi of China and Cao Bang of Vietnam, respectively. Therefore, we consider that the first clade is *O. tonkinensis*, while the second clade may represent a cryptic species, and we temporarily refer to the second clade as *Ovophis* cf. *tonkinensis*.

Qiu et al. (2024) described *Ovophis jenkinsi* from Tongbiguan Township, Yingjiang County, Yunnan Province, China, which is closely related to *O. monticola*, based on morphological and molecular data. However, Qiu et al. (2024) did not include all available sequences of *O. monticola* in their phylogenetic analysis. In this study, we integrated all available sequences of *O. monticola* and the sequences of *O. jenkinsi*, and the analysis showed that among the sequences previously considered to belong to *O. monticola*, those corresponding to specimens from Gandaki of Nepal and Nyalam of China formed one clade, while those corresponding to specimens from Kachin of Myanmar formed another clade together with the sequences of *O. jenkinsi*; the genetic distance between these two clades was 7.2%. Therefore, according to the type locality of *O. monticola*, we consider the clade containing sequences of specimens from Nepal and Nyalam of China to be *O. monticola*, and the other clade to be *O. jenkinsi*. That is to say, *O. monticola* is restricted to Nepal and adjacent southern Xizang of China and northern India, while *O. jenkinsi* is also distributed in northern Myanmar in addition to western Yunnan.

David et al. (2024) considered that *Trimeresurus monticola meridionalis* Bourret, 1935 may be a distinct species, and it is likely that either *Ovophis anitae* or the *Ovophis* sp. 1 in Zeng et al. (2023) is a junior synonym of *T. m. meridionalis*. It can be confirmed that *Ovophis zhaoermii* sp. nov. is definitely not a junior synonym of *T. m. meridionalis*, although in both species the third supralabial is larger than the fourth one. *Ovophis zhaoermii* sp. nov. differs from *T. m. meridionalis* by having relatively more subcaudal scales (57–64 vs 47–54), having more ventral scales (146–148 vs 134–136), some of the subcaudal scales being unpaired (vs all of the subcaudal scales being paired), the dorsal scales being in 22-21-17 rows (vs 25-25-19 or 23-23-17 rows), and having continuous white spots on the dorsal surface of the tail (vs no visible white spots on the dorsal surface of the

tail). However, it cannot be determined whether *O. anitae* or the *Ovophis* sp. 1 in Zeng et al. (2023) is conspecific with *T. m. meridionalis* currently. Until there is sufficient evidence, we retain the validity of *O. anitae* and refer to the *Ovophis* sp. 1 in Zeng et al. (2023) as *Ovophis* cf. *meridionalis* for the time being.

The area where *Ovophis zhaoermii* sp. nov. was discovered is located within Yuanyang Guanyinshan Provincial Nature Reserve, which is far away from human settlements. There are intact primary forests in the nature reserve, and they are legally protected. Therefore, we consider that this species is currently not threatened by humans.

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## Additional information

### Conflict of interest

The authors have declared that no competing interests exist.

### Ethical statement

No ethical statement was reported.

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### Data availability

All of the data that support the findings of this study are available in the main text.

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